DISCOVERING THE REGULATORY CONSIDERATIONS OF THE FEDERAL AVIATION ADMINISTRATION: INTERVIEWING THE AVIATION RULEMAKING ADVISORY COMMITTEE

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ABSTRACT

Maintenance Resource Management (MRM) training for aviation mechanics has become mandatory in many industrialized countries since 1998. Yet, to date, MRM training remains optional in the U.S. Interestingly, a similar safety discipline, namely Crew/Cockpit Resource Management (CRM), is mandatory for pilots, flight engineers, flight attendants, and dispatchers and is regulated in the Federal Aviation Administration's (FAA) Federal Aviation Regulations (FARs). If MRM training is important to enhance aviation technicians' working behavior, the rationale to not regulate it opens a window for study. This research aims to inductively investigate the FAA's regulatory rationale concerning MRM training based on direct inputs from the FAA's Aviation Rulemaking Advisory Committee (ARAC) members. Delphi methodology associated with purposive sampling technique was adopted. The result revealed that the FAA cannot regulate MRM because the aviation industry is strongly opposed to it due to the lack of training budgets, the need of a quantifiable cost-effect analysis, concern over the FAA's inspection workforce, an ongoing voluntary alternative called the Air Transportation Surveillance System (ATOS), the government's lower priority on maintenance after 9/11, and the airlines' tight embracement of operational flexibility without regulation.

INTRODUCTION

Alongside the prompt development of the air transportation system in the U.S., aviation safety has always been the foremost concern of the government (Carmody, 2001; Donnelly, 2001), the general public (Bowers, 1997; Wells, 1999), as well as the air transportation industry itself (Proctor,

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1999). Since 1978, the passage of the Airline Deregulation Act (the nature of laissez-faire and free marketing) has forced airlines to further promote, or at least maintain, a required level of safety in order to compete with business rivals, to provide better operations, to survive, and most importantly, to become profitable (Button & Stough, 2000; Chang, 1986; Marks, 1999). However, today's airline passengers tend to book their flights based on price either via the Internet or from traditional travel agencies (Johnston, 2001). In response, airlines have reacted by providing services that charge the lowest possible fares in order to attract more customers and ultimately survive in the Darwinian post-deregulation battlefield. However, maintaining a risk-free operation needs a sufficient financial backup. While charging passengers airfare with marginal or no profit, airlines may provide safety training for their employees only to satisfy the minimum mandatory requirements from the FAA. Providing non-regulatory safety training could become a financial burden to airlines.

REVIEW OF MAINTENANCE PERFORMANCE AND SAFETY TRAINING

The accident investigation of the fatal mishap of Alaska Airlines Flight 261 in January 2000 is pointing to flawed jackscrew lubrication and rushed inspection (Finnegan, 2002; Fiorino, 2001). After Alaska Airlines' accident, many aviation enthusiasts see again that the goal of zero accidents cannot be achieved without the cooperation of hazard-free maintenance. The fact is that Alaska Airlines' accident, which may be a result of non-flight errors, is not an isolated case in aviation history. The accidents of TWA Flight 800, ValuJet Flight 592, and Air Midwest Flight 5481 had alerted the air transportation industry that non-flight operation does play a significant role in today's aviation safety (Lu, 2001; Alexander, 2004). As a result, the task of eliminating non-flight errors cannot be overemphasized.

Maintenance Human Errors

The main purpose of aircraft maintenance is to keep aircraft airworthy (King, 1986). Although technologies have been enhanced, aircraft maintenance remains quite challenging and the working environment is still extremely intense (Butterworth-Hayes, 1997; Delp, Watkins, & Kroes, 1994; Richardson, Rodwell, & Baty, 1995). With this in mind, human factors affecting maintenance performance are inherent and should be treated carefully. A survey conducted by Boeing Company and other safety researchers revealed that the main factors contributing to maintenance mistakes were the following: (a) boredom; (b) failure to understand instructions well; (c) rushing; (d) pressure from management; (e) fatigue; (f) distractions at critical times; (g) shift work; (h) poor communication; (i) use

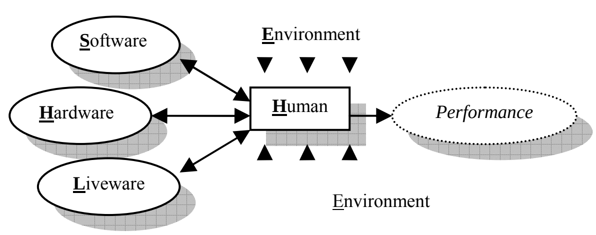
of incorrect parts and tools; and (j) unauthorized maintenance proceedings (Al-Almoudi, 1998; Taylor & Christensen, 1998). In addition, Transport Canada's human factors research resulted in the recognition of a so-called *Dirty Dozen*—lack of communication, lack of teamwork, lack of knowledge, lack of resource, lack of assertiveness, lack of awareness, fatigue, stress, distraction, pressure, complacency, and workplace norms—that identifies the human factors requiring immediate attention (Grant, 1995). Wood (1997) and Drury (1999; n.d.) echoed this and further reported the major problems of aviation maintenance technicians (AMTs)—fatigue, physical impediment, foreign object damage, ignorance, misconduct, and overlook—when conducting aircraft maintenance/inspections. Hence, when working on an aircraft, AMTs could make mistakes and are not error-free (Wood, 1997).

The nature of aircraft maintenance is complex and needs physical and mental strength. The working climate is tense, involving managerial pressure, working efficiency, shift work, interpersonal communication, and external sociological influences (Lu, 2001). Without a doubt, the maintenance issues associated with human factors are almost identical to those that affect flight performance—communication, workload, fatigue, stress, social environment, physical limitations, and personal health (Orlady & Orlady, 1999).

Maintenance Resource Management

Like CRM training for pilots and associated flight crews, MRM was developed based on the experimental findings of human factors research introduced by the National Aeronautics and Space Administration (NASA) in the early 1970s. Human factors studies the interaction between human and software (S), hardware (H), environment (E), and liveware (L), thereby forming the SHEL model of aviation safety theory (Krause, 1996; see Figure 1).

Figure 1. SHEL Model of human factor and aviation safety.[1]



[1] Krause, S. S., 1996, Aircraft safety – accident investigations, analyses, & applications and Federal Aviation Administration, 2000, System safety handbook: Practices and guidelines for conducting system safety engineering and management.

Likewise, maintenance human factors training is an analytical science of the factors influencing maintenance performance and consequently seeks to eliminate or dilute the negative impact from an explicit safety factor (Orlady & Orlady, 1999). Because MRM training originated in the findings of human factors research, implementing MRM training could help improve an AMT's performing compatibility, self-awareness, interpersonal communication, and effectiveness at resource usage (Capitelli, 1988; Lavitt, 1995; Mudge, 1998; Orlady & Orlady, 1999).

Legislative Basis for MRM Training

Not until 1988, and after Aloha Airlines' accident resulting from the aircraft's aged fuselage being ripped open in flight, did the FAA conduct the first official safety meeting concerning aircraft maintenance. As a result, Congress proposed a bill—the Aviation Safety Research Act (H.R. 4686)—which was passed on November 3, 1988, by the Senate (Public Law 100-591). This bill provided grants to the FAA and expanded the research domain aiming to make a connection between aviation safety and human factors (US GPO, 1990). The Aviation Safety Research Act of 1988 sought to pursue the relationship between human factors and flying, aviation maintenance, and air traffic control (US GPO, 1997). The FAR Part 121 Subpart N and Special FAR Part 71 Training Program has regulated today's CRM training rooted in the human factors paradigm for flight crews (pilots and flight engineers) since 1990. The Aviation Safety Research Act was revised in 1996, mandating human factor training for flight attendants and dispatchers.

Moreover, in 1991, three years after the Aloha Airlines accident, Congress passed the Airline Passenger Safety Enhancement Act, which focused on improving airline maintenance procedures and standards. This legislation urged airlines to: (a) reform inspection routines for aging aircraft, (b) innovate inspection technology training for maintenance personnel and professionalism, and (c) restructure a 15-year inspection development (Bowen & Lu, 2000). Unfortunately, Congress did not identify the sociological factor behind Aloha's accident—the oppressive management pressure that constrained maintenance time (Friend, 1992). The fatal crash of ValuJet Flight 592 in 1996 was due to an oxygen canister fire resulting from ill-trained ground crews; it led to the passage of the Aviation Safety Protection Act of 1997. Congress proposed another bill, the Aircraft Safety Act of 2000 (H.R. 3862), after the tragedy involving Alaska Airlines Flight 261 in January 2000. This legislative reaction, in the wake of another aviation disaster, aimed to prevent fraud involving aircraft maintenance and defective parts (Bowen & Lu, 2000).

RESEARCH QUESTIONS

The aviation industry (Capitelli, 1988; Lavitt, 1995; Orlady & Orlady, 1999) and the FAA (Mudge, 1998) have recognized the benefit of MRM training to enhance aircraft maintenance safety. To date, MRM or an equivalent training is mandatory in EU nations (Joint Aviation Authority, 2001) and Canada (Transport Canada, n.d.). A similar training (CRM) for flight crews, flight attendants, dispatchers, and flight engineers is mandated in the FAA's FARs. With the legislative foundation upheld by the Aviation Safety Research Act, Passenger Safety Enhancement Act, and Aviation Safety Protection Act, the FAA's non-regulatory stance in relation to MRM is worth investigating. Without a mandatory requirement, the current training status quo in the aviation industry should be made known to the flying public as well.

> Question 1: From the viewpoint of Aviation Rulemaking Advisory Committee (ARAC) members, what is the rationale underpinning the non-regulatory status of Maintenance Resource Management (MRM) training for aircraft maintenance technicians (AMTs)?
> Question 2: What is the de facto safety training and attitude of the airlines toward Maintenance Resource Management (MRM) training under the current non-regulatory status quo?

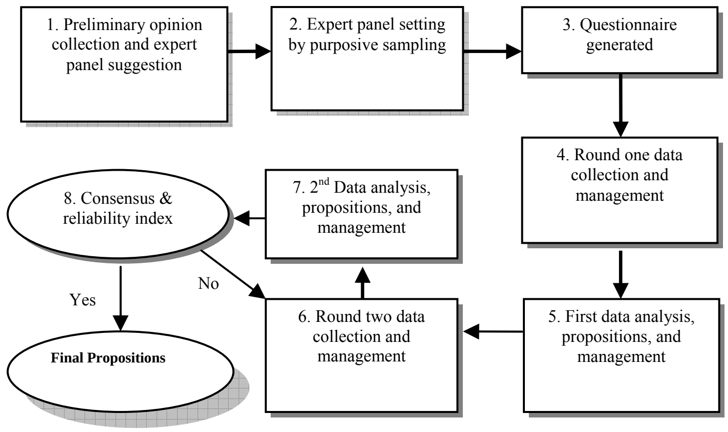
RESEARCH METHODOLOGY

In order to manifest sound theories regarding the rationale of the FAA's decision making, the research questions were thoroughly explored through the use of a divergent approach, a qualitative methodology. The author selected the Delphi methodology and initiated purposive sampling skills.

Delphi Techniques

The Delphi method is an exploratory and discursive-format data collection tool that allows researchers to gain the highest creditability of data through reciprocal procedures (see Figure 2); Bellenger, Bernhardt, & Goldstucker, 1976; Rayens & Hahn, 2000; Zapka & Estabrook, 1999). In this study, the Delphi technique was directly applied to answer the research questions concerning the rationale of decision making and current industry-wide MRM training. The existing policy determinants can be coined and epistemological relations among variables can be identified.

Figure 2. Research execution processing – the flowchart of policy Delphi



Purposive Sampling

In contrast to the widely recognized random sampling approach adopted in most quantitative studies, purposive sampling focuses on the heuristic exploration and in-depth interview of selected key informants who possess a direct connection to various essential data, practical experiences, and genuine resources (Babbie, 1998; Maykut & Morehouse, 1994). Key informants—as *representative units* rather than randomly selected samples (Bellenger, Bernhardt, & Goldstucker, 1976)—are those who are closely involved in the area being studied. In addition, the snowball technique was accompanied with the usage of purposive sampling because qualitative researchers often start their data collection from the accessible research sites of key informants (Babbie, 1998; Berg, 2001; Creswell, 1998; Maxwell, 1996; Royer & Zarlowski, 1999).

Aviation Rulemaking Advisory Committee

This study recruited FAA ARAC members as key informants. One of the attempts by the federal government to collect public opinion from external sources in order to assist policymaking was the passage of the Administrative Procedure Act of 1946 and the Federal Advisory Committee Act (FACA) of 1972 (Adamski & Doyle, 1999). Since 1972, the FAA has established various ARACs for different legislative issues such as aged aircraft, air traffic control, navigation system, cabin safety, flight operation, and maintenance safety. The purpose behind the FAA's establishment of an

ARAC is to build a communicative channel between the federal government, the public, and the aviation industry under the power of the FACA. ARAC members are also assigned with a task that focuses on regulatory communication and harmonization between the FAA FARs, Canadian Aviation Regulation (CAR), and Europe's Joint Aviation Regulation (JAR). This study selected fourteen ARAC members who worked with the FAA regarding mandatory maintenance human factors training (formerly proposed by the FAA as FAR Part 66). Unfortunately, three of the selected ARAC members could not participate in this study, resulting in an eleven-member Delphi panel.

Data evaluation methods

Coding is a systematic procedure for finding the significant meanings, norms, or unique themes of texts by cross-references and comparisons (Creswell, 1998; Gough & Scott, 2000). For grounded-theory type qualitative research, like that which uses the Delphi methodology, the design of topical subquestions can be considered the blueprint of qualitative data analysis (QDA) and meaningful coding (Maxwell, 1998; Miles & Huberman, 1994; Tafoya, 1986). In this study, computer software is useful to examine the reliability of data analysis. EZ-Text software was applied to manage database and to compile the index of coding reliability (CDC, 1998).

Reliability and validity of the research

The reliability of this project rests in the category of research consistency in addition to EZ-Text's index. This consistency involved the key researcher's operational processes of Delphi techniques and the informants' conformability of results (steps 4, 5, 6, 7, and 8 in Figure 2). Moreover, in addition to external peer-review for validity during the questionnaire generation phase, personal biases were clarified and rich and thorough descriptions were collected (Berg & Latin, 1994; Creswell, 1998; Lincoln & Guba, 1985). In this study, in order to gain the highest validity and reliability, the initial findings were returned to ARAC panelists for review and consequently gained their conformity based on Delphi criterions.

FINDINGS

This section outlines the findings after two consecutive personal interviews over a six-month period. The key informants, aged between 36 and 46 years old, have comprised the largest portion of the sample, whereas most panelists possess educational level with Bachelor of Science degrees or above. All panelists have more than 10 years of working experience in the aviation field. Eight of the 11 panelists have received MRM or human factors education before the date of the interviews. Panelists have

participated in the FAA's rulemaking activities at least once each year, and most of them have taken part in the FAA's rulemaking activities associated with maintenance safety regulations more than three times in the past. A brief analysis of the panelists' backgrounds is shown in Table 1.

Table 1. Demographic distribution of panelists (N=11)

	*Number (n**)*	*Descriptor*	*Percentage*
Age			
	6	36-46 years of age	54.5
	2	47-58 years of age	18.1
	3	59 years or older	27.4
Education			
	1	High School diploma	9.1
	1	Associate degree	9.1
	3	Bachelor's degree	26.3
	5	Graduate degree	46.5
	1	Doctorate degree	9.1
Working experience			
	11	10 years or more	100.0
ARAC activities			
	3	New member	27.3
	8	Senior member	72.7
MRM/HF training			
	4	Never received	36.3
	7	Received	63.6

Note. N = total number of panelists
** n denotes the number of particular panelists

Question 1: From the viewpoint of Aviation Rulemaking Advisory Committee (ARAC) members, what is the rationale underpinning the non-regulatory status of Maintenance Resource Management (MRM) training for aircraft maintenance technicians (AMTs)?

After the interviews and data coding process, the synthetic findings from the ARAC members were grounded. The panelists concurred that the following six policy determinants played a central role in the FAA's rulemaking in light of the current non-mandatory MRM or maintenance human factors education.

1. Budgetary constraints. The FAA should have to consider the possible cost and how that would impact the air transportation industry's current and future financial status. In particular, air carriers are facing ongoing financial difficulties that impede them from accepting any new regulations.

2. Lacking a persuasive cost-benefit analysis result. There is no strong or virtually quantifiable data showing a positive cost-benefit result from MRM. Therefore, lacking sound evidence, the air transportation industry would be reluctant to support such regulation.

3. The effective operation of the Air Transportation Oversight System. Despite its nature of volunteerism that requires the industry's participation from the bottom-up, the ongoing safety inspection mechanism—ATOS—is sufficient in maintaining a reasonable degree of aircraft maintenance safety.

4. The air transportation industry's demand for operational flexibility. The air transportation industry demands more operational flexibility to accomplish safety goals without coercion from the government. In addition, different categories within the industry would like to conduct their own safety training that focuses on specific needs. The standardized procedures and activities of MRM could hinder creative means to accomplish the goal of maintenance safety.

5. The FAA's capacity and the capability of safety inspectors. The FAA's safety inspection capacity and the capability of safety inspectors is one of the policy determinants that hampers the FAA in mandating MRM and the industry in upholding its proposed regulations. First, the FAA has long been criticized by the industry regarding the capability of their safety inspectors. Second, since the FAA is suffering manpower shortage of safety inspectors, new MRM regulations could worsen the situation since the FAA would have to dispatch more safety inspectors to scrutinize the industry's MRM training compliance.

6. Low policy priority. After 9/11, the FAA's manpower and budgetary resources had been reallocated to airport security and related safety issues. Most regulatory proposals petitioned by the government are mainly in favor of enhancing airport security as well as homeland security. National security and anti-terrorism activities had outweighed the importance of regulating MRM or maintenance human factors training.

Question 2: What is the de facto safety training and attitude of the airlines toward MRM training under the current non-regulatory status quo?

Based on the ARAC key informants' input, major air carriers voluntarily participate in the ATOS system; yet small/regional airlines and fixed based operators (FBOs) do not or only occasionally provide MRM or related training. Regardless of the major air carriers' engagement in ATOS surveillance, "when considering the degree of MRM training without regulation, a voluntary MRM conducted by the industry seems sporadic," as stated by one panelist. Some panelists echoed and noted that the most critical elements impeding the industry's voluntary implementation of MRM training are: (a) current financial hardship; (b) a long-term unpredictable cost; and (c) unclear benefits. Therefore, "the industry would like to

continuously comment on MRM training via participation in rulemaking rather than by supporting MRM regulation," as remarked by one panelist.

Regarding Question 2 concerning the contemporary U.S. aviation industry's training status without the regulatory enforcement, several important facts were discovered.

1. A profit-driven industry. Airlines are believed to be "exclusively profit-driven" as remarked by one panelist. Hence, the airlines' willingness to "conduct MRM training without federal enforcement is low due to cost concerns." Another panelist stated that "the support of the top management and cost-benefit analyses" were considered essential for an airline to decide whether or not to implement voluntary safety trainings. "When something is non-regulatory it will be done only if the management sees a cost-effect case" as echoed by another panelist. "Regional airlines or small FBOs would not implement MRM due to a budgetary shortage" as addressed by one panelist. However, "the major airlines would like to implement such training voluntarily because these airlines already have good technical training programs and MRM is a natural extension" as another panelist replied.

2. The pros and cons of a non-regulatory MRM status. There are some disadvantages of maintaining a non-regulatory MRM training, said the panel. One panelist pointed out that, "the lack of mandatory MRM training could be harmful and risky, and could impact maintenance safety in the long run." Without a doubt, "safety training would enhance safety performance," another panelist replied. Because MRM training focuses on human factors related to aircraft maintenance tasks, one panelists stated that "without MRM training, the AMTs might unintentionally perform tasks with risks." Another panelist further warned and argued, "not until the industry had encountered severe aviation mishaps caused by maintenance errors would the industry recognize the importance of communication, teamwork, self-awareness, and the dangers of physical fatigue, mental stress, and coercive management." In addition, one panelist stated, "without regulation of MRM or defined requirements, organizations wander all over the map in terms of an accurate path of [MRM] training." Moreover, according to panelists' feedback, there are also some advantages if MRM training remains optional in nature. One panelist argued, "to some extent, volunteer programs are more stringent than regulations." It is simply because airline services "are influenced multi-dimensionally" by customers' changing needs. Therefore, "if training requirements are flexible and lax, customer service can be easily and continually improved in a timely manner" as echoed by another panelist. Of course, not being mandated to do the training means cost saving. One panelist stated that "without mandatory enforcement from the government, the airlines do not have to conduct safety training and can therefore save on operational costs." The fact is that "a non-mandatory MRM means cost reduction," stated by another panelist.

3. The attitude of the industry regarding a mandatory MRM. "The industry is opposed to a mandatory MRM training" as one panelist addressed. "The air transportation industry is also afraid of any regulations because the FAA would possibly take the advantage if they have the chance," another panelist argued. Another panelist said that "any regulations without appropriate evidence, showing that MRM would create enough return on investments, would be denied" by the industry. Even within the regulatory sphere, the industry would "just implement enough training" for aircraft technicians as another panelist replied. In particular, while the FAA hoped to promote MRM training for aircraft maintenance technicians without regulation, "when it comes to the discussion of regulations, the air transportation industry would demand a thorough understanding of requirements beforehand, such as technical support, training duration, possible cost and benefit, and a quantifiable result," said another panelist.

Reliability Report

To ensure the reliability of qualitative findings, EZ-Text's index of coding reliability was measured after the completion of the second-round interview. According to EZ-Text's manual (CDC, 1998) and Miles and Huberman's (1994) rule of coding reliability, the percentage of agreement between two coded datasets should exceed 90 percent in order to ensure reliability. In addition, the Kappa Index should show 1 in the contingency table. In Table 2, the percentage of agreement regarding each code (policy determinant) is above 98 percent and the Kappa index is 1. This means that the coding process of raw data had high reliability across two codebooks.

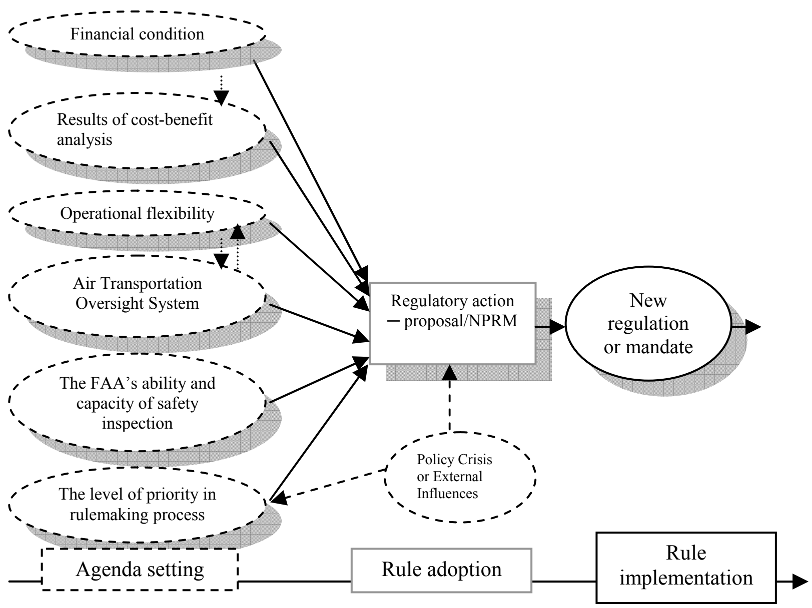
Table 2. Reliability Report—Kappa Index

Codes	Percentage of Agreement	Kappa Index
Financial constraint	99.373	1
Cost-benefit analysis	98.746	1
ATOS	99.373	1
FAA's ability	99.687	1
Operational flexibility	99.373	1
Policy priority	98.746	1

DISCUSSION: THE MODEL OF DECISION-MAKING

The findings portray a conceptual picture for readers and pull most possible independent variables (policy determinants) together arriving at a description of the FAA's rulemaking rationale regarding a mandatory MRM training. A schematic chart of relations showing a theoretical construct (from processing phase of policy premise finding, agenda setting, implementing policy action, to policy evaluation) among all found themes and policy determinants is illustrated in Figure 3.

Figure 3. Schematic relationship among variables



To further explain, this model of decision-making indicates that if the financial condition of the aviation industry was healthy or generating sufficient profits, the results of cost-benefit analyses would become less important. This is because the industry would then have enough monetary resources to implement MRM training. Furthermore, regardless of regulatory status, without sound evidence yielded from cost-benefit analyses, the willingness of supporting a mandatory MRM training is weak because the element of budgetary constraint is not compressed nor eliminated.

The aviation industry is tightly embracing ATOS on a voluntary basis. In addition, the demand for operational flexibility from the air transportation industry positively influences the FAA's decision making. These two elements (ATOS and operational flexibility) are impediments to the industry's acceptance of MRM regulation. Certainly, the air transportation industry would prefer to maintain the current voluntary nature of its cooperation with the FAA without the threat of violations. In addition, the industry is concerned with the capacity of FAA's safety inspectors. The shortage and quality of the safety inspectors has been a long-time criticism of the FAA's enforcement actions. If this manpower deficit can be removed, some of the resistance of MRM regulation from the industry could be reduced. Finally, the FAA will need to take priorities into account when enforcing the MRM agenda, especially in light of other priorities resulting from 9/11.

It is believed that—barring a legislative crisis such as a major airline accident resulted from the lack of MRM training—these six rulemaking determinants largely shape the FAA's decision-making behavior.

CONCLUSION

The core argument of this study is that while resource management or human factors training is mandatory for pilots, flight engineers, dispatchers, and flight attendants, it is controversial that such training becomes optional for AMTs or non-flight workers. A nonregulatory MRM also draws attention to the current training status for AMTs. This study has explored the rationale behind the FAA's stance in retaining a non-regulatory MRM or maintenance human factors training for the air transportation industry.

Based on the interview of ARAC members, policy determinants are unveiled showing that the FAA should closely evaluate several essential issues of the industry when it comes to the debate of proposed regulations. Those determinants are identified as (a) the industry's financial status; (b) a sound evidence of cost-benefit analysis; (c) the scope of malleability of the ongoing voluntary ATOS; (d) the allowance of operational flexibility for the industry; (e) the FAA's inspection capacity and the ability of inspectors; and (f) the level of policy priority.

Regarding the current training status without regulatory enforcement, major air carriers are willing to voluntarily participate in the alternative system, namely ATOS. Yet, the regional airlines and FBOs do not intend to provide MRM to maintenance technicians due to the cost. Despite the major air carriers' efforts, when considering the degree of MRM training without regulation, voluntary MRM conducted by the entire airline industry seems rare and difficult. While the industry as a whole does not likely support the

MRM regulation, only major airlines with more cash flow or revenue would be able to incorporate MRM into their current maintenance safety training.

Post-9/11, the financial status of the entire industry is increasingly fragile. Although ATOS requires a reasonable amount of MRM training for non-flight employees, top management would still evaluate the possible investment returns in safety training before taking further action. As a result, when MRM is non-regulatory, it will be done only when the advantages are identified or when sound evidence associated with cost-benefit analyses is accessible.

Finally, it is still possible to regulate MRM training in the future. The evidence underpinning this conclusion is the six policy determinants described. In other words, when any of the determinants prevails—that is, (a) the industry is making enough profits; (b) cost-benefit analysis shows a sound result; (c) the FAA has sufficient numbers of qualified inspectors; (d) the ATOS does not work well; (e) the FAA decides to grant the industry with operational flexibility; or (f) the government is aware of the urgency of such regulation—regulating MRM or related ground safety training would encounter less resistance.

Limitation

The results of this study were retrieved from two consecutive rounds of interviews with selected panelists from ARAC members who were closely involved in the debate of MRM regulation with the FAA. Unfortunately, one important resource—FAA's rule-makers—was not able to take part in this research due to a variety of reasons. Thus, future research should focus on the data collection and comparison from the FAA rule-makers. Moreover, although panelists addressed that the working culture may change if technicians receive MRM or maintenance human factors training, evidence of this has not been recorded nor is it accessible. The cost-benefit analysis of MRM training did play a crucial role in this study. To prepare a report for the FAA's future decision-making, follow-up research should focus on a longitudinal assessment of behavioral change, error reduction, and cost savings affiliated with MRM training.

Special Notice

Many aviation researchers have argued that the FAA has been *captured* by the industry (Carmichael, Kutz, & Brown, 2003) based on George J. Stigler's theory. In this study, regardless of the designated personnel from the FAA in charge with a specific regulatory provision, the author reviewed the backgrounds of ARAC members and discovered that most ARAC members are mainly from the industry such as unions, airlines, aviation organizations, and manufacturers. As a result of this study, the FAA's

decision-making process was, to a great extent, in favor of the industry and was captured accordingly.

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